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Research data consistently demonstrates that white school children score higher on tests of academic ability than Negro children of the same age and grade level, and that this discrepancy increases with time. Is this discrepancy due to a lack of learning proficiency on the part of Negro children or to a lack of learning opportunity? In an attempt to answer this question, 48 lower class Negro children and 48 upper-middle class white children from kindergarten, first, and third grade were given (1) a paired-associate (P-A) task, (2) the Peabody Picture Vocabulary Test, and (3) the Raven Progressive Matrices test. The latter two tests are used to measure intelligence, while the P-A task measures learning proficiency. The test results showed that the white children performed significantly better than the Negro children on tests (2) and (3). The P-A data showed a small discrepancy between the two groups (diminishing in magnitude with increasing grade level) which suggested that the tested Negro children should have learned as well as the white group. Lack of skill in learning tactics appears to be the main handicap of these children as they continued to improve on P-A tasks with practice while the other group did not. Instructional programs that are concrete, explicit, and specific offer the most to lower class children who need skill mastery. Tests to measure learning proficiency must also be developed. (WD)

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Intelligence Quotient Versus Learning Quotient: Implications for Elementary Curricula[1]

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The topic of Race and Intelligence includes a number of intriguing phenomena. Each of these is rich in implications for educational research and practice, but none will be of facal concern in this paper. Instead, let me direct your attention to a related phenomenon: Race and School Achievement. Specifically, start with the fact that at virtually all grade levels, white children succeed more often than black children and that black children fail more often than white. Or, to state the fact more accurately, on the average, white children score higher on tests of school achievement than black children. This then is the phenomenon we will examine: race and school achievement.

To be more concrete, let me cite a particular example. Within a sample of third-grade children we worked with recently, the difference between white and Negro groups in terms of mean percentile scores for reading on the Stanford Achievement Test was imposingly large: 71:7 vs. 21.8. A difference of this magnitude is not unusual in comparisons like this one. Moreover, such differences are usually larger, the higher the grade level of the children observed. Thus, the phenomenon is comprised of two parts: (a) there is a discrepancy between Negro and white school children with respect to their performance on tests of school achievement; and, (b) the size of the discrepancy is relatively small at the first-grade level, substantial by grade three and even larger by grade six.

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The task for educational research is to account for this discrepancy and the task for educational practice is to deal with it so as to promote the greatest possible educational growth.

First, let us examine the problem of accounting for the phenomenon. What are the factors that might be responsible for the discrepancy in the degree of school success achieved by white and Negro children? There are a large number of candidates. Rather than listing them, however, we will limit our discussion to only two: intelligence and learning proficiency.

One way of accounting for the Negro-white discrepancy in degree of attained school success is in terms of corresponding differences in the average intelligence of the two populations. For the purpose of this discussion, let me make it clear that by the term "intelligence," I mean performance on standardized intelligence tests. Simply, the argument is: high-IQ children perform better in school than low-IQ children; the average IQ of white children is higher than the average IQ of Negro children; therefore, white children achieve higher degrees of school success than Negro children.

There is implicit in this argument a crucial assumed process that mediates between differences in IQ and differences in performance on school achievement tests--that process is learning. Learning provides the link between degree of intelligence and degree of school success. Presumably, the higher a child's IQ, the more efficiently he learns; the more efficiently he learns, the more he learns; the more he learns, the more he retains; and the more he retains, the higher his score on tests of school achievement.

Notice, the argument implies that just as there is a discrepancy between the average IQ of white and Negro children, there is also a similar discrepancy between the average learning proficiency of white and Negro children.

Fortunately, this is an implication that can be tested empirically. Indeed, it must be tested empirically for it is crucial for the validity of the argument.

One line of reasoning that may be used in support of this implication inheres in a major interpretation of the meaning of intelligence test scores. This interpretation is that the IQ is, in fact, a measure of learning proficiency. As you all know the IQ for an individual is obtained by comparing his performance on a given test with the performance of other individuals of the same or closely similar chronological ages. The assumption, of course, is that equal chronological age implies equivalence in learning opportunities. Such equivalence is not precise but may be presumed to be exact enough for the purpose of asserting that age peers have had roughly the same amount of time to learn the materials necessary for successful performance on the given intelligence test. Accordingly, the IQ is an estimate of learning efficiency in that it measures what has been learned in the course of some constant unit of time by a collection of age peers.

In this manner it is sensible to assume that intelligence tests measure learning proficiency averaged over heterogeneous and long-term learning situations. Obviously, however, the assumption is warranted only so long as it is true that all of the subgroups of children having the same chronological age have had equal opportunities to learn the material relevant to performance on the intelligence test. It is patent that there is gross variation in opportunity for relevant learning depending upon the social-class and ethnic group membership of the child. Given this, it is necessary to provide empirical support before accepting the assertion that intelligence tests measure learning proficiency, despite the cogency of the <u>a priori</u> reasoning.

It is precisely this question that has concerned us in our research during the past several years: Is a child's IQ an accurate reflection of his learning proficiency? The first task in an attempt to answer the question is to select a means for measuring learning proficiency. One of the problems in doing so is that there is good reason to posit more than a single kind of learning proficiency (Stevenson, Hale, Klein, and Miller, 1968). Because of this, our strategy in making a choice has been to rely on two criteria. The first is methodological: Is there adequate information available about the operating characteristics of the learning task itself? The second criterion is an empirical one: Does the kind of learning method selected relate to performance on school learning tasks?

What kinds of learning tasks are there a bout which ample information is available? The obvious answer is the well-worked pool of laboratory learning tasks: serial, paired-associates or free recall. Of these three, the most attractive for analytical reasons is that of paired-associates learning. As you know, the task requires the memorization of pairs of items in such a way that when one item of a pair is presented later, the other pair member can be recalled. The method of paired-associates has been so much used in laboratory research on human learning that an entire book has been devoted to the results produced with it (Goss and Nodine, 1965). Even this volume could not present anything like a comprehensive account of all that is known about the method. Thus, it can be selected with full assurance that it qualifies under the first criterion, namely that its operating characteristics should be well-known.

Beyond this advantage, however, paired-associates tasks raise immediate objections when proposed as methods for measuring learning proficiency.

After all, it is true that this method, along with most of the other widely-used methods of investigating human learning in the laboratory, has traditionally been viewed as a technique for analyzing the basic processes of rote learning. The aim of many studies of paired-associate learning has been to understand the simplest, most elemental processes in human verbal learning. Both these appelations, simple and rote appear, by themselves, to disqualify the method of paired-associates from serious consideration as a way of estimating a child's learning proficiency.

My own view is that the appelations are more wrong than right and that the method is worth exploring for three major reasons. First, there is now considerable evidence that the paired-associates method not only permits but usually elicits mental activity of considerable ingenuity, especially in those who are efficient learners (Martin, Cox and Boersma, 1965; Montague and Wearing, 1967). Second, it has been shown empirically that performance on paired-associates tasks is related as closely to performance on tests of school achievement as is performance on intelligence tests (Stevenson et al, 1968). Thirdly, if one analyzes carefully the kinds of school learning that are required of children, especially in the earlier grades, one finds that many of these closely approximate the paired-associates paradigm in their formal structure. Finally, in using paired-associates tasks as a way of analyzing the phenomena of racial and socioeconomic differences in school achievement we have found them fruitful in allowing us to subdivide the larger phenomena into more manageable problems. Furthermore, we have found the task amenable to use as a test for individual differences; that it can be used with children of varying backgrounds; that it makes the same demands on children of age ten as it does on children of age four; and that it produces reliable measurements on children of widely varying backgrounds.

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Let me support these contentions by reviewing for you two studies that were recently completed using a paired-associates test that we presently have under development at Berkeley. The first study was designed to evaluate several characteristics of the test itself by determining the kind of data it would produce in connection with the problem of developmental differences in the size of the white-Negro discrepancy in test performance.

The test was administered to samples of kindergarten, first and third-grade children drawn in equal numbers form two kinds of schools; ones serving lower socioeconomic class, Negro residential area and ones serving an upper-middle class white residential area. Of the total of 288 children tested, 48 were drawn from each of these six populations.

Each child received two forms of the test, the second being administered two days after the first. A form consisted of two lists of 25 paired-associates was presented for two study and for two test trials. The child's score on that form of the test was the total number of correct responses he gave on all four of the test trails across both of the lists. Similarly, the child's score on the second form of the test was the total number of correct responses he produced to the other two lists on the second day.

Each child also received two other tests: the Peabody Picture Vocabulary Test and the Children's form of the Raven Progressive Matrices. These two tests, of course, are used to estimate intelligence. They differ rather markedly in their task characteristics. The Peabody is a multiple-choice vocabulary test whereas the Raven consists of a series of pattern completion problems that vary from very simple to relatively difficult ones.

All three tests were individually administered.

The results on each of the tests are shown separately for the six samples in Table 1. Notice that these results are reported in terms of Mental Age for the Peabody, Number of problems solved on the Raven, and mean numbers of correct responses on the two forms of the paired-associates test. Since the three scales of measurement are widely discrepant, it is difficult to compare the results directly. Accordingly, for each test, the scores have been converted to distributions characterized by a mean of 100 and a standard deviation of 15 within each of the three grade levels sampled. This conversion yields the familiar IQ in the case of the Peabody and the Raven tests and a score that may be called a learning quotient or IQ for the paired-associates test. The results after the conversion are shown in Figure 1 and the mean difference between the performance of the Negro and White samples is shown separately for each test and each grade level in Figure 2.

As you examine these data, let me call your attention particularly to some of their features. First, note that the difference in performance of the Negro and white samples is very large on both the Peabody and the Raven tests and that the size of these differences appears to remain at least as large at first and third-grade levels as it is at kindergarten. Indeed, in the case of the Raven, the difference favoring the white samples is significantly larger at the older than at the younger grade levels. This effect, of course, illustrates the well known notion of a cumulative deficit in intelligence test performance among lower-class Negro children. In marked contrast to both these features of the data for the intelligence tests, the results produced by the paired-associates task show relatively small differences between the Negro and white samples. Furthermore, the magnitude of the

difference decreases significantly at the older grade levels, showing not a cumulative deficit but rather a diminishing deficit.

The results themselves are clear. Now, what are their implications for the issue we started with, race and school achievement. First, it is a simple matter to explain the difference between the Negro and white samples in terms of differences in intelligence, that is, IQ scores. But, secondly, it is not warranted to phrase the explanation in terms of the assumption that these differences in IQ affect school achievement because they imply a corollary difference in learning proficiency. By the time the lower-class Negro children reach the first grade, they can learn nearly as proficiently as the upper-middle class white children.

What then do intelligence test and school achievement test scores tell us about Negro children in comparison with white peers? Simply, they tell us that at a given grade level, the Negro children have not learned as much as white children. But these scores do not tell us that Negro children cannot learn as much as white children. Indeed the results from the paired-associates test suggest that Negro children should be learning as well as white children of comparable ages, especially beyond the kindergarten level. Thus the question: Why aren't they?

There are several possible answers to this question. Let me suggest three that are consistent with the results of the study we have just reviewed. First, lower-class Negro children come to school with less skill in learning tactics than middle-class white children. Accordingly, they learn less during their early school years, especially the kindergarten year. In fact, what they probably learn less of during that year is how to learn in school, that

is, under the conditions of learning that are imposed during the primary years. Secondly, even though the basic learning skills of lower-class Negro children improve almost to the point of equality with those of middle-class white children by the time they are into the first-grade year, they are not quite as well-honed. Support for this assertion may be found in the fact that at every grade level, including the third, the lower-class Negro children show significant gains from the first to the fourth of the paired-associate lists they learn. In contrast, after the kindergarten level, the middle-class white children do not show significant improvement across these four lists. It is almost as if upper-middle class white children come to school with virtually complete mastery of the skills that are involved in what we have come to know as learning sets for paired-associate tasks. The Negro children, on the other hand, have still not fully mastered these basic skills by the third-grade level.

Finally, it is reasonable to suppose that to an even greater degree the Negro children have not adequately mastered the skills necessary to learn successfully under classroom conditions of learning. Remember, the paired-associate learning task was administered individually with a minimum of distractions available. Furthermore, the task was interesting for the children, their objectives were clearly specified, they were able to practice the behaviors demended of them and the task itself provided feedback for every response. All these features of the paired-associates test are rarely characteristic of the conditions of learning in the classroom.

Let me offer another kind of support for this last contention. The paired-associates test was made up of five different kinds of items,

distinguishable by the way they were presented. For all five kinds, every pair was made up of two familiar things such as a DOG and a GATE. However, a pair such as this one could have been presented in any one of the following five ways. (1) The child simply hears the words "Dog" -- "Gate". (2) The child sees a picture of a dog standing beside a gate. He hears nothing. (3) The child sees a picture of a dog standing beside a gate and hears the words "dog" -- "gate." (4) The child sees the picture of the dog standing beside the gate and hears the sentence "The dog opens the gate." (5) The child sees a picture of the same dog and the same gate but in this case the dog actually walks to the gate and opens it as the child hears the words "dog" -- "gate."

The results for each of these types of items are very interesting. (See Figure 3). First, for all six samples, performance is significantly better for every one of the higher-numbered Item Types than for the adjacent lower numbered one; (2) is better than (1), (3) is better than (2) and so on. The fascinating thing, however, is that the performance of the upper-middle-class white children is slightly but significantly better than that of the lower-class Negro children on all save one of the types of items, namely, type three where the child both sees the pictures and hears the names of the objects in the pictures.

Let me speculate about this for a moment. The reason for the Negro-white discrepancy on the other item types is that for each one successful performance requires that the child engage in some kind of mental activity on his own without being instructed to do so. When he just hears the names, he must supply an image of the objects; when he just sees the pictures, he must supply the names of the objects; when he hears a sentence, he must

supply a corresponding action image; and, when he sees the action picture, he must supply the corresponding sentence description. In contrast to all these cases, when the child both sees the picture and hears the names of the objects depicted, he need not (at least at these ages) supply anything more. The theory is then, that middle-class children have learned to supply the additional mental activity spontaneously--they have learned to elaborate the materials they are presented to learn--wheras the lower-class Negro children have not.

If this theory is correct, and if it bears extrapolation to the learning of school subject materials, the idea is that in the great preponderance of instances, school learning materials are presented in such a way as to require spontaneous elaboration on the part of the child. Since such activity is not as habitual with lower-class Negro as it is with middle-class white children, and since such activities are not explicity taught in school, the performance deficit for the Negro children and the corollary frustration mount with every succeeding grade level.

Now, if this is indeed the case, then, it should be fruitful to train children in elaborative techniques of learning. We have begun to try to do just this. Let me describe a small study we conducted last year and use it to make two points. The first is that such training is possible; the second is to illustrate again the use of the paired-associates test and the derived IQ score that it yields.

The study was conducted with second-grade children drawn equally once again from a lower-class Negro and an upper-middle class white population. Initially, the children were all administered one form of the paired-associates test. On the basis of this performance, the children were assigned in a

randomized blocks design within each sample to one or another of the three conditions used in the study. The first condition was a no-contact control in which the children simply received one form of the paired-associates test as a pretest and the other form as a post-test. In a second condition, the training condition, the children were given instruction in the use of each of the four elaborative activities mentioned earlier: envisioning objects when presented their names; naming objects seen; making up sentence descriptions of episodes involving pairs of objects; and, envisioning these episodes. Children in this condition were trained in squads of two and were seen on each of five days for approximately 20 minutes every day. In the third condition, Practice, the children were seen for the same amount of time and number of days as the children in the training condition. They did not receive instruction in elaborative activities, but they did practice learning paired associates and rehearsing the pairs that they had seen. The results of this study are presented in Table 3 in terms of initial and final IQ scores for the three conditions in each of the two samples. For the middle-class sample, significant improvement was produced by both the training and by the practice conditions relative to the control. But note that training in elaborative activities was no more effective than simple practice in PA learning for these children. In marked contrast, the lower-class Negro children derived virtually no benefit from simple practice. Nevertheless, substantial improvement was produced in their performance by elaboration training. Furthermore, elaboration training elevated the performance of the Negro children to the level of that for white children in the control conditions.

It is also worth noting that the magnitude of the training effect for the Negro children in IQ terms is rather more substantial than that found in

many training studies in which IQ scores are used to evaluate the success of instruction. But more important, the results demonstrate (a) that lower-class children can be trained to learn more effectively and (b) that a test of learning proficiency is useful in evaluating the efficacy of the training.

For myself, the implications of these results are clear. First, the development of tests to measure learning proficiency is crucial for obtaining an understanding of the phenomena encompassed by the topic of Race and School Achievement. Second, a major objective of curricula in the early years of schooling, especially for lower-class Negro children, should be that of providing mastery of elaborative learning skills, through concrete, explicit and specific instructional programs. Perhaps in the pursuit of these two aims, the degree of school success attained by disadvantaged children can be increeased to the level indicated by their basic learning proficiency.

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Table 1

Performance on the Peabody, Raven and Paired-Associate Tests as a Function of Race and Grade Level

		Grade Level		
		K	1	3
Peabody	Negro	59.6	71.7	83.8
MA (mos.)	White	81.9	91.3	122.9
Raven	Negro	12.8	14.9	17.3
# correct	White	14.9	20.0	26.8
Paired-Associate	Negro	7.2	10.0	12.0
# correct	White	9.3	10.8	13.2

Table 2

Learning Quotients Before and After Training

as a Function of Conditions and Race

		Training	Practice	Control
Negro	Before	93.4	94.9	95.3
	After	113.3	106.4	106.7
White	Before	106.4	104.1	104.5
	After	118.2	119.0	109.3

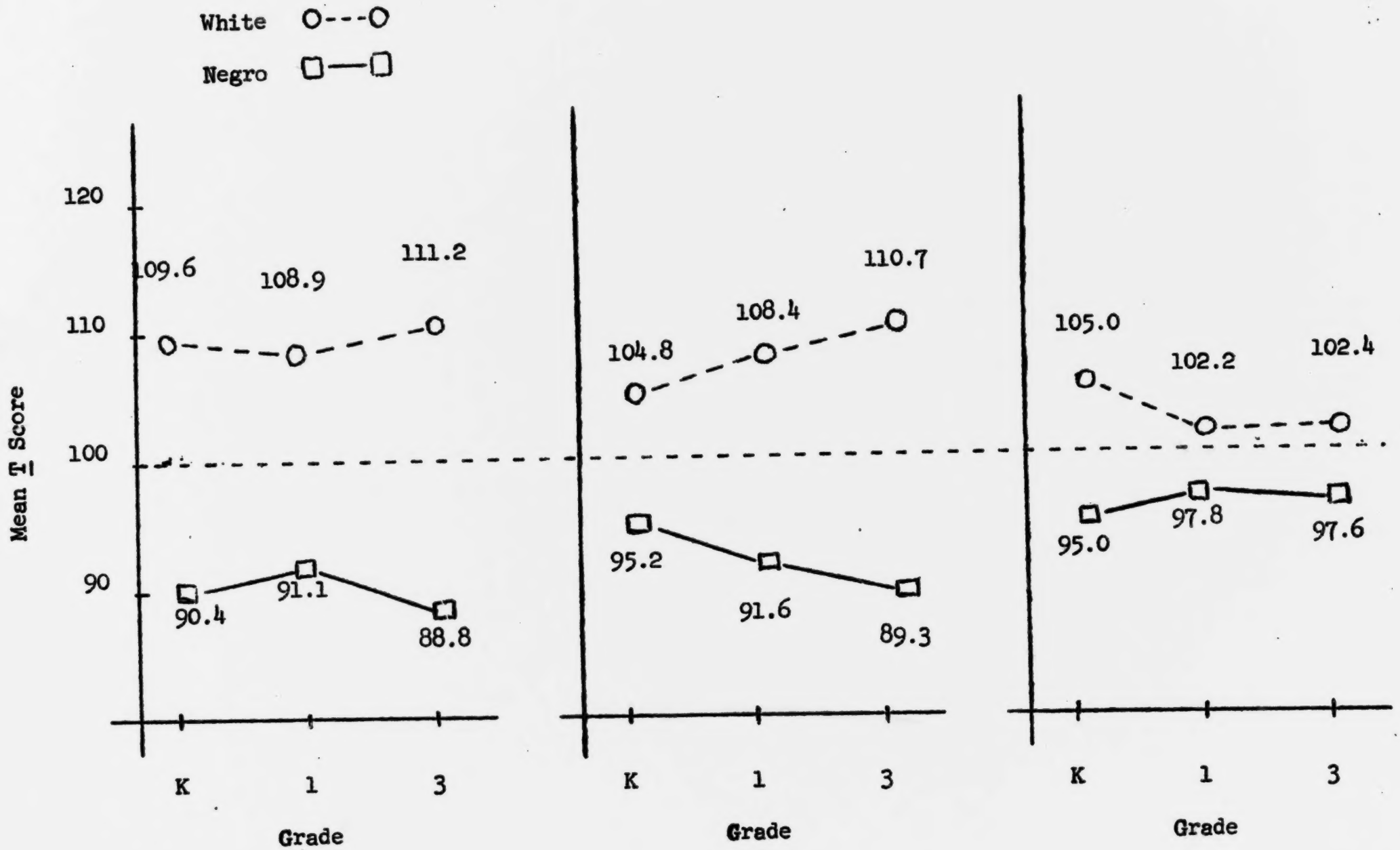

Figure 1

Performance on the Peabody, Raven and Paired-Associate Tests in T-scores as a Function of Race and Grade Level

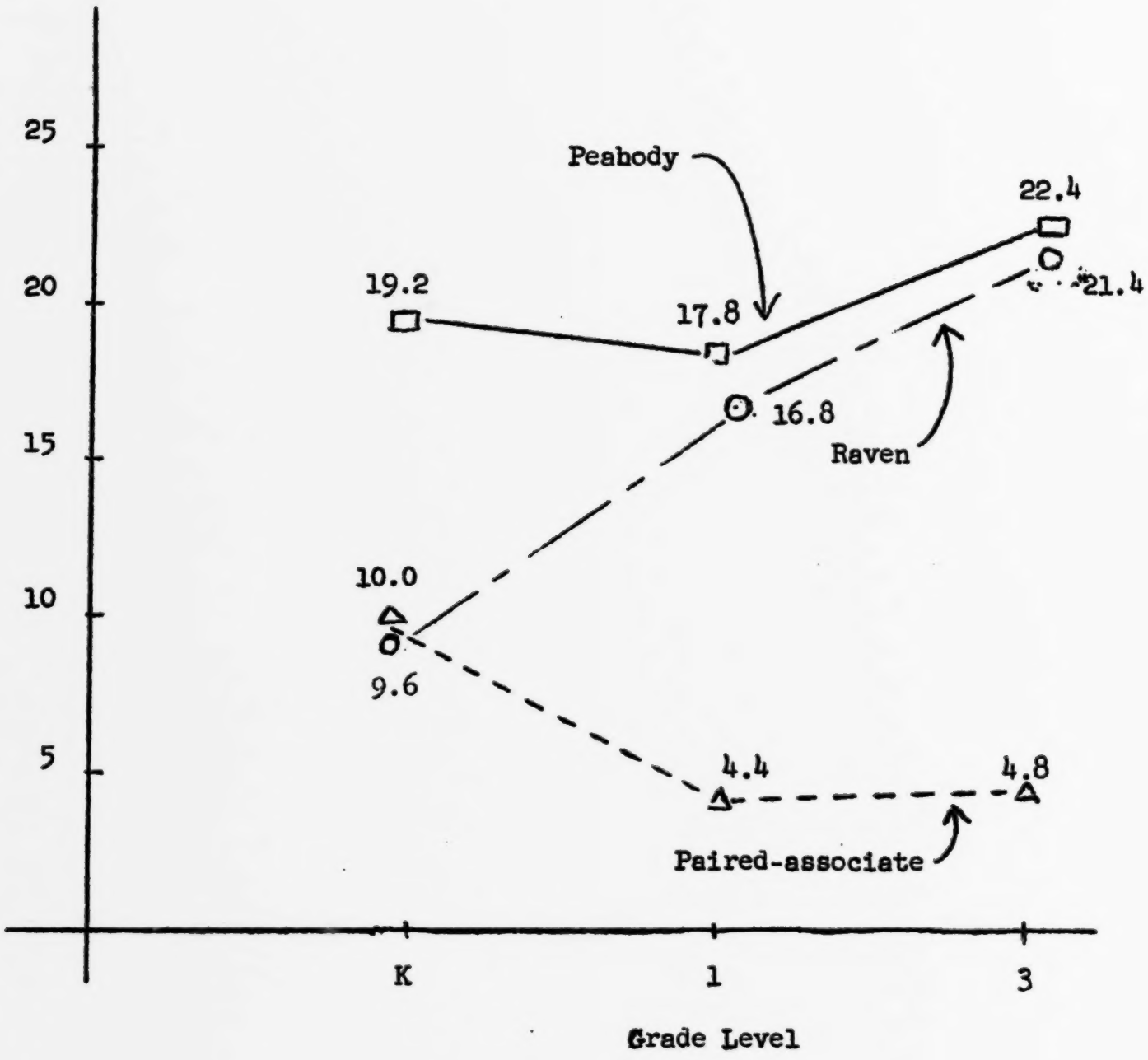

Figure 2

Mean Difference in Performance of White and Negro Samples as a Function of Test and Grade Level

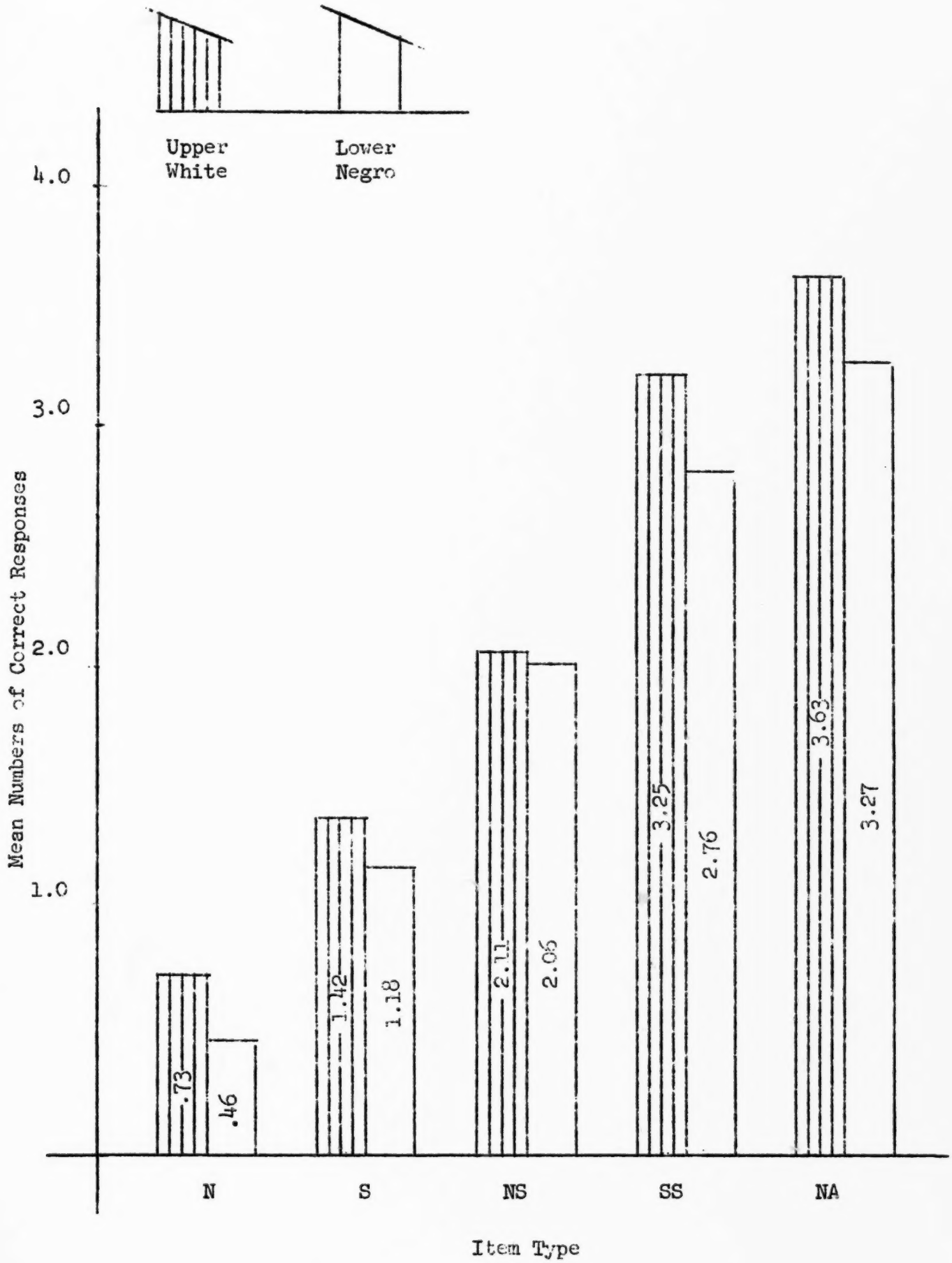

Figure 3

Paired-Associate Test Performance as a Function of Conditions and Race